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OF

FORESTRY,

AGRICULTURE, SHIKAR & TRAVEL.

EDITED BY

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THE

INDIAN FORESTER.

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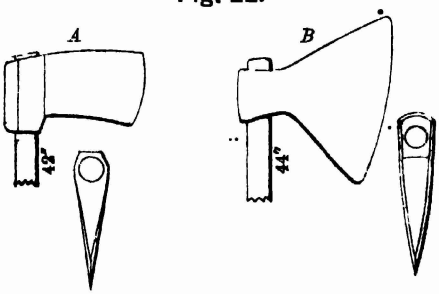
NOTES ON THE UTILIZATION OF FORESTS.

(*Continued from page 258*).

2. *The trimming axe.*

The trimming axe serves to remove the branches of fallen trees and to dress and rough-hew logs. The same axe with which a tree was felled will do equally well for trimming off branches, but for all large branches and for dressing logs a heavier axe with a broader blade is much more serviceable. Indeed, in dressing fallen timber the axe is best swung vertically in order to secure the full amount of momentum, and its weight may hence be as much as the axe-man can control. In the conifer forests of the Western Himalayas the weight often runs up to 8 lbs., and even more. To gain additional momentum long handles are used, the length ranging from 3½ to 4½ feet. In *Fig.* 22 are reproduced two patterns

Fig. 22.



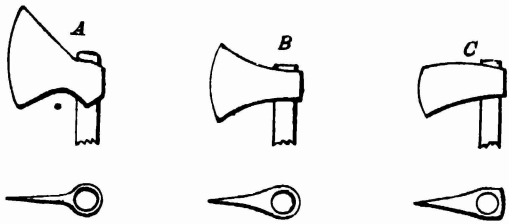
Indian trimming axes ($\frac{1}{10}$*th original size*).
A.—Amritsar pattern (up to 6 lbs.).
B.—North-West Himalayas (from 6 to 9 lbs.).

of Indian trimming axes. Although the advantages of using special trimming axes are unquestionable, yet woodmen in most

parts of India actually do all their work with the ordinary felling axe alone.

Under this head may be mentioned the light, broad, thin-bladed, one-handed axes used for lopping off small branches and for topping off saplings (*Fig.* 23).

Fig. 23.

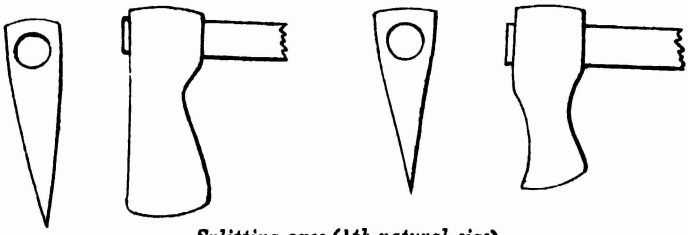


Light one-handed axes ($\frac{1}{10}$th natural size).
A and B.—Used in North-West Himalayas. Weight, 12 *ounces.*

3. *Splitting axes.*

These axes, as the name implies, are used for splitting up thick billets or large rounds into sections. Their action is thus almost purely a shearing one. Hence they need not be so sharp as the two descriptions of axes already described, but they should be as heavy as the heaviest trimming axe. Contrary to the rule for those axes, their weight should lie all round the eye in order to give them as much driving power as possible. As they are often used as hammers for driving in wedges, there should also be plenty of metal in the back. A slight convexity of the faces of the blade is not objectionable as long as the taper near the edge is sufficient. *Fig.* 24 represents two useful patterns of splitting axes.

Fig. 24.

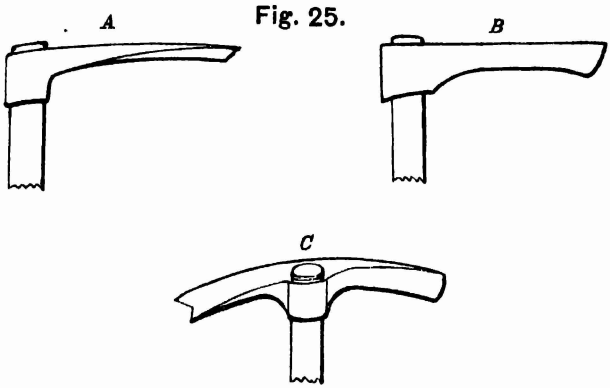


Splitting axes ($\frac{1}{8}$th natural size).

4. *Grubbing axes.*

Grubbing axes serve the double purpose of digging up the soil round roots and severing those which do not exceed 3 or 4 inches in diameter. The blade should always be slightly curved, and about 12 inches long and from 2 to 4 broad at the edge. *Fig.* 25 represents three effective forms.

Fig. 25.



Grubbing axes ($\frac{1}{10}$*th natural size*).

Article 3.—The Saw.

The saw consists of a thin, comparatively broad blade or plate of steel, one edge of which is toothed. The saw is essentially a tool for use across the fibres of the wood. If the fibres of wood were perfectly parallel and there were no discontinuity due to branches, knots and other causes of transverse or irregular growth, then all longitudinal separation would be effected by tools acting solely on the principle of the wedge. It is because of such discontinuity that the saw is also used for cutting wood longitudinally, *ripping* as it is technically called.

The following are some of the technical terms used in connection with saws:—

Rake, the inclination of the line of the teeth, in a straight saw, to the direction in which the saw moves.

Space, the distance from tooth to tooth measured at the points.

Face of a tooth, the profile of the tooth *facing* the side towards which the saw moves in cutting.

Back of a tooth, the opposite profile.

Gullet or *throat*, the extent of opening between two successive teeth.

Gauge, the thickness of the saw.

Set or *bent set*, the extent to which the teeth are bent to either side of the plane of the blade.

Straight set, when the teeth lie entirely in the plane of the blade.

Pitch, the angle formed by the face of a tooth with the line passing through the points of the teeth.

Kerf, the thin plate of wood removed by the saw in the form of *sawdust*.

Other technical terms will be explained as they occur.

ACTION OF THE SAW.—For the sake of clearness we will assume that the saw works across the fibres. A perfect saw makes its way through the wood by combined *cutting*, *tearing*, and *shaving*. Suppose *A*, *B*, and *C* in *Fig.* 26 to represent the faces (considerably enlarged) of three consecutive teeth, *A* and *B* being filed obliquely

Fig. 26.

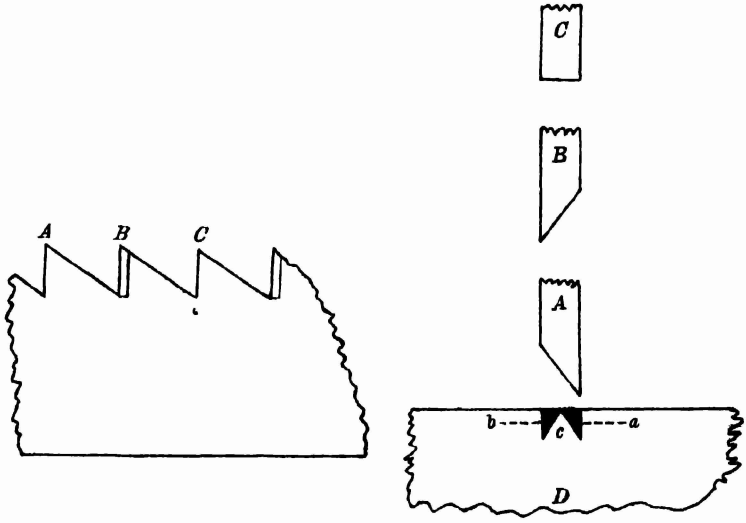


Diagram illustrating action of the saw.

to an edge on different sides, while *C* is filed at right angles to the plane of the blade. As the saw moves forward, *A* clears in the wood *D*, the opening *a* partly by cutting, partly by tearing asunder the fibres which come in its way. Similarly the tooth *B* clears in its passage the opening *b*. The triangular portion *c* left between *a*

and *b* is then shaved off by the broad edge of the tooth *C*, which is hence designated a *clearance* tooth. In the preceding explanation we have supposed only one tooth of each kind acting, but actually the opening *a* may be made by two or more teeth following in succession; and similarly the opening *b* by as many teeth filed away in the other direction, while a single clearance tooth suffices to remove the section of the fibres between *a* and *b*. The action of the saw is greatly facilitated if each clearing tooth shaves off only a portion of the section left by the cutting teeth that precedes it. This end is secured by making the clearing teeth slightly shorter than the other teeth. In India the backs of the teeth are never filed to an edge, and the action of the saw is consequently reduced to simply tearing and shaving, or, to use a simple and more expressive term, to rasping.

The portions of fibre torn and shaved off (the sawdust), unless they were at once removed out of the way of the saw, would interfere with its passage, and, by coming between the blade and the cut surfaces of the wood, eventually cause it to jam (*buckle*). Hence the necessity of making the gullet large enough to afford sufficient room to hold the sawdust until it falls out as the saw continues to advance.

SHAPE OF THE TEETH.—A great variety of shapes have been devised, especially in America, where the saw is better understood than in any other part of the world. For us, who have to work in a backward country like India, it will suffice to note only a few of the principal forms.

If a saw is required to cut in one direction only, the teeth have the well-known form approaching more or less nearly that of a right-angled triangle. The pitch of the teeth may vary from 80° to 100°, according to the softness of the wood. It is usually high in circular saws on account of their great speed. If the quantity of sawdust is large, the gullet is enlarged by hollowing out the back of the teeth and giving the bottom of the gullet a curved outline (*Fig.* 27). Such an outline is an advantage under all circumstances, as it prevents any tendency of the blade or teeth to crack.

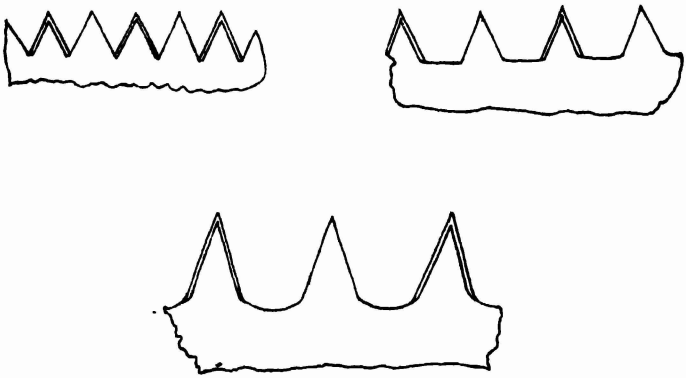
Fig. 27.

Rounded gullet.

If the saw has to cut in both directions, the teeth must assume the form of isosceles triangles, the bottom of the gullet being, according to the quantity of dust to be cleared, either

an angle (*Fig.* 28), or a curve (*Fig.* 29), or a straight line (*Fig.* 30).

Figs. 28, 29, 30.



A very powerful combination of the two preceding forms, which is of American design, is the M tooth (*Fig.* 31).

Fig. 31.

American one-man saw.—M-teeth.

Sawdust occupies from four to six times the space it did in the wood, the proportion being greatest in the case of soft and porous woods. The height of the teeth should, therefore, always be considerably greater than the depth cut through at each movement or revolution of the saw, so as to increase the depth of the gullet. Hence the softer and looser grained the wood is, the longer will be the teeth. Greater capacity can be secured for the gullet also by a wider spacing of the teeth, and actually the wideness of the spacing is determined by the softness and porosity of the wood; but it has been found from experience that the force required to move the saw increases with the fewness of the teeth, so that a limit is

fixed for the spacing, which ought never to be exceeded. In the case of hard woods the necessity of close spacing is further accentuated by the fact that each single tooth can do comparatively little work, and that consequently the more numerous they are, *i.e.*, the closer the teeth, the more effective is the saw. Hence the superiority of M teeth and other similar forms, which increase the number of teeth for a given length of blade.

The angle between the two profiles of a tooth may vary between 70° and 45°, being about 45° to 50° for very soft woods and 65° to 70° for very hard woods. Hence, since we know that the number of teeth must increase with the hardness of the wood, saws for very hard woods should always have teeth in the form of isosceles triangles, and should hence cut when drawn in either direction.

The line passing through the points of the teeth (clearance teeth alone obviously excepted) should be an even line; that is to say, some teeth should not project beyond others, otherwise the former alone will do the work and the cutting power of the saw will thereby be diminished. This proviso being satisfied, the length of the teeth need not always be the same. There are many woods so constituted that in cutting them the saw can be moved only with difficulty at the commencement of each cut, and there is much splintering and tearing of the wood if the cut is commenced with coarse teeth. To obviate this drawback, the size of the teeth is gradually increased, so that the finest commence the cut and the coarsest finish it.

The teeth should be filed away on one side to a sharp edge. If the saw is to cut in one direction only, the face alone should be so filed (see *Figs.* 26 and 27); if in both directions, both faces of the teeth should be sharpened (see *Figs.* 28, 29, and 30). Alternate teeth should have their sharp edges on opposite sides. The Indian sawyer nearly always neglects to give the teeth of his saw any sharp edge at all, probably in order to diminish wear; but against this diminished wear must be set the much greater loss he suffers from the smaller quantity of work he turns out.

SET OF THE TEETH.—The teeth are given a set in order to enable them to clear in the wood a passage wide enough for the blade of the saw to pass through without any tendency to buckling. The softer or more coarse-fibred or gummy or resinous the wood, the stronger must be the set; but it should be just strong enough to serve its purpose, otherwise there is waste of wood due to too thick

a kerf, and the teeth get worn away unnecessarily quickly, and the surfaces cut are unnecessarily rough. The strongest setting should not increase the width of the cutting edge to more than double the gauge of the saw. As a rule, ripping saws require very little set, since the two sections, from the wood in the interior being moister, bend away outwards and make room for the saw. The set should be uniform throughout the length of the saw, for if one tooth projects sideways beyond the rest, besides that it will become worn much quicker, it will also scratch the wood and produce a rough surface. The set should be the same on both sides, otherwise the saw will cut more freely on the side of the stronger setting and have a tendency to run towards it. The Indian sawyer sets the teeth of his saw either by blows or by leverage with a hand saw-set (*Fig.* 32). The teeth should be set alternately to different sides—a very obvious warning, but one which our sawyers very often neglect.

Fig. 32.

Saw-set.

In a bent set each tooth can cut on only one side, and generally the teeth have a tendency to spring in and are more subject to side strains. To obviate these defects the *spread* set has been devised, in which the points of the teeth are flattened out so as to become broader than the rest of the blade. This kind of setting is perhaps too advanced for introduction into India.

THE BLADE.—The gauge of a saw ought to be only just sufficient to give it the requisite stiffness. The disadvantages of a thick-bladed saw are that it requires more set, is in need of more frequent sharpening, is more difficult to file, wastes more wood, and, being heavier and cutting a wider kerf, is more fatiguing to use. If the blade is too thin, the saw is liable to twist and make an uneven kerf, the result being buckling. The Indian method of filing the teeth, so that they cut when being drawn towards the operator, permits of the use of much thinner blades than the English method, which makes the saws cut in thrust. Saws are sometimes made thickest along the cutting edge and become gradually thinner towards the back. This is in order to dispense with the necessity of any set at all.

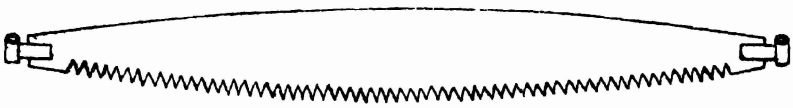
In order to reduce friction to a minimum, the blade should be as smooth as possible, and its width should be no more than what is required to prevent it from bending in its own plane. The

smoother and more uniform it is, the thinner and narrower a saw you can use. A smooth blade is also less liable to rust. To diminish the friction, most saws are made gradually narrower towards one extremity. Some cross-cut saws are made broadest in the middle (*Fig.* 33), not with a view to minimise friction, but in order, without using too much metal, to place most of the weight where it is required.

When stiffening frames (*Fig.* 36 and 38) are used, both the thickness and width of the saw are reduced to a minimum.

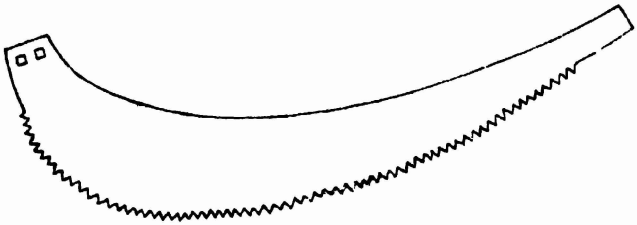
The cutting edge is very often made on a convex curve (*Fig.* 33), or with a "crown" or "breast" (*Fig.* 34), to adapt it to the

Fig. 33.



Curved Cross-cut Saw.

Fig. 34.



Delhi Saw.

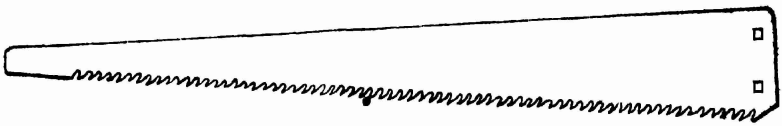
natural rocking motion of the hand and arm.

A saw should be springy and elastic and at the same time highly tempered. A soft saw dulls sooner, drives harder, and does not last so long as a hard saw. Nevertheless saws of Indian manufacture are often made of merely tough iron.

In a straight saw the rake influences the pressure of the saw on the wood during the progress of cutting. The rake should therefore be regulated according to the hardness of the wood to be sawn and the height and pitch of the teeth.

THE MORE COMMON FORMS OF SAW USED FOR FOREST WORK IN INDIA.—These are the ordinary pit saw (*Fig.* 35) and the frame

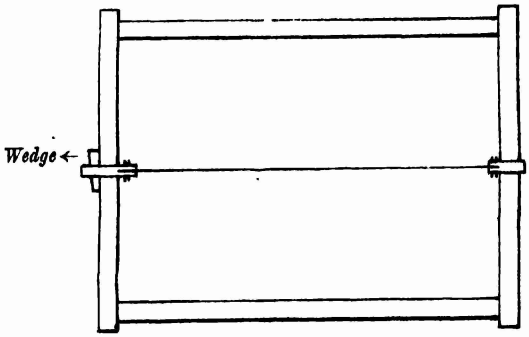
Fig. 35.



Pit Saw.

saw (*Fig.* 36) for longitudinal cutting; the curved cross-cut (*Fig.*

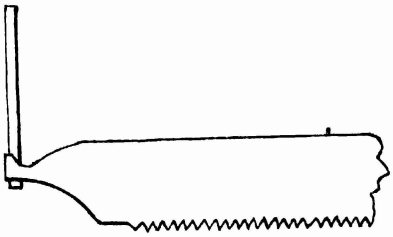
Fig. 36.



Frame Saw for longitudinal cutting.

33) and straight cross-cut (*Fig.* 37) saws for felling and logging; the frame cross-cut saw (*Fig.* 38) for cutting up into billets; and

Fig. 37.

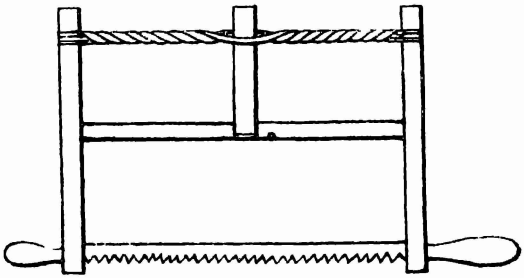


Straight Cross-cut Saw.

the Delhi saw (*Fig.* 34) for all three purposes. In the Western

Himalayas and in the Punjab a straight one-hand saw about

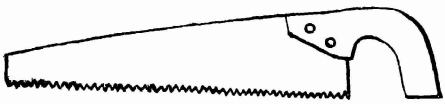
Fig. 38.



Frame Cross-cut Saw.

3 feet long (*Fig.* 39), like an ordinary ripping saw, is used for logging. It is, however, a very ineffective tool, and when a tree is more than about 2½ feet in diameter, it has first to be split down the middle with wedges. There is no reason why the American one-man saw (*Fig.* 31) should not be at once introduced as a substitute. It works very quickly and cuts both ways.

Fig. 39.



Rude one-hand Cross-cut Saw.

The use of the circular saw for conversion in the forest is too restricted in this country for a special description of it to be introduced here.

In logging fallen trees a curved cutting edge offers several most important advantages : it suits the natural rocking motion of the hands and arms of the men, it requires less force to pull the saw (since the teeth come successively into action one by one, never several together), the sawdust is never an obstruction (since it is at once cleared), the saw can cut down to the very bottom of the log without risking the teeth against the ground or requiring the log to be raised off the ground, and the operators' hands are always well above the ground and cannot therefore be hurt.

In felling also a curved edge is to be preferred, as it causes very much less fatigue.

In longitudinal cutting, a curved saw, besides suiting the natural motion of the hands and arms, is easier to pull, cuts deeper at each stroke, enables the bottom sawyer to stand or kneel well

away from the falling sawdust, and can be used to cut with right down to the ground.

In the use of both the curved and the frame saws for longitudinal cutting the logs have to be raised off the ground only at one end, whereas, when the pit saw is employed, owing to its great length, the logs have either to be entirely lifted off the ground on two high supports or placed on supports resting across a long deep pit. The curved Indian saw, owing, no doubt, to its very rough manufacture, offers the very serious drawback of leaving a very uneven surface.

(To be continued).

"GHATI'S" STRICTURES ON DR. SCHLICH'S BOOK.

I HARDLY think "Ghati's" remarks in the number of the "Indian Forester" for October-December, 1889, on the former "Directors" of Forest Policy in India are in good taste. In the first place, I do not suppose that Dr. Schlich intended to detract from the services rendered by his executive officers. The chief credit of a successful policy is naturally due to those who direct it, just as the chief credit of a successful war is attributed to the Commander-in-Chief conducting it.

Then as regards the policy of expediency which "Ghati" sneers at. He should remember the amount of prejudice and opposition to forest conservancy which the direction have had to contend with, and be thankful that even a moderate measure of success has been attained. No doubt, the present area of reserved forest is utterly inadequate to the wants of the people, because so large a proportion of them are situated far away from the centres of consumption, and only first class timber can be brought out from them and sold at a profit. Firewood and second class cannot be utilized, because it would not pay to bring them to the market. Take the average outturn of the reserved forests of India and Burma for the year 1887-88. It is only 1·34 cubic feet per acre, which gives about ·22 cubic feet per head of population, or, say, 10 lbs. of wood per head, besides about $\frac{1}{6}$th of a bamboo !! This is of course a mere drop in the ocean to what is really required. I reckon that where wood is fairly cheap an average family will use about a ton of firewood alone per annum, not to mention building materials; and if they could get it, the whole population of British India would use up something like 2,000,000,000 cubic feet of firewood alone, or about 43 times the present outturn of the

reserved forests. Of course, they do not use that quantity, because they cannot get it, and burn cowdung instead.

The present small outturn of the reserved forests is due, firstly, to the remoteness from the markets of many of them ; secondly, to the large areas fit for little else than grazing included in them ; thirdly, to many of them having been taken over in a temporarily ruined state and the consequent necessity for giving them a rest ; fourthly, to the want of working plans. The last two courses will yearly diminish and the annual average outturn proportionately increase, but it will be long before it reaches a ton an acre per annum, unless we exclude the grazing areas. If we exclude the latter, the area of the reserved forest available for growing timber would be reduced by about 25 per cent. and might be put down at 2,500,000 of acres instead of 3,400,000. But even a ton an acre per annum on the present area would not be sufficient to provide the population of India with firewood alone. It is therefore abundantly clear that the present reserved area is quite insufficient for the requirements of the country, and that even the 20 per cent. of the area of the country mentioned by Dr. Schlich as the maximum would be insufficient. I think, then, that everything should be done to acquire larger areas in those provinces which have a deficiency. What we especially want is more forest in populous districts, and no opportunity of acquiring areas in such localities should be allowed to slip. We shall have to work in concert with District Officers in acquiring such areas, but now that fuel and fodder accessible to cultivators are recognised to be a boon to them, the co-operation of Revenue Officers should not be difficult to obtain.

In connection with the subject of the supply of wood to the people it has often occurred to me that something might be done at settlements to encourage the rearing of trees by cultivators on their land. Would it not be practicable to make some deduction of assessment for the trees growing on the land and for every tree planted and brought to sapling stage up to a certain limited number per acre? A census might be taken at the end of every decade. If by some such measures ryots could be induced to rear trees it would be a great boon to them. Apart from the utility of their produce, they would afford protection to the land against the hot dry winds of summer, shade and food to cattle in hot weather, and return a quantity of leaf mould to the soil. I think the subject is one of importance in a hot country like India, and well worth the consideration of District and Settlement Officers.

F. B. D.

A PROTEST.

In your article on the training of Forest Officers, with which I generally agree, I was painfully surprised to read your opinion as set forth on p. 169, to the effect that not one in 50 of us ever attempts to keep abreast of the progress of European forestry. This I could pass over in silence; but when you go on to make the astounding assertion that "a shrewd junior civilian, or an ordinarily sagacious merchant's assistant or bank clerk" would have done equally well, I feel bound to enter a strong public protest against any such suggestion, even though emanating from an editorial and professorial chair, which is by its very existence a mutely eloquent refutation of the statements which have raised my bile. As a matter of fact, a considerable number of very "ordinarily sagacious merchant's assistants, bank clerks," military amateurs, and nondescripts of sorts have been shovelled in over our heads; but it is not apparent that they have done even as much as we have, and that only after profiting by our teaching and example. Indeed, I find it difficult to put my ideas into that courteous language which is so desirable and necessary.*

Here are we, just emerging victorious from a struggle for existence with the "shrewd civilian," who has only yielded ground foot by foot at the sword's point, and is beginning to take us *au sérieux*, when you drop at our feet, like a thunderbolt from a clear sky, a weapon which he will not fail to turn against us. But if I can, I propose to hack this weapon about a bit, and see if it is sound metal, and one we need not have been afraid of. What have we done? Well, we have established that chair of which you are so distinguished an ornament. Your shrewd civilians, &c., &c., would have been too shrewd and sagacious to have done it, even had he attained the idea. And it is not the only one of its kind.

We have got a Forest Act, for which we owe small thanks to the shrewd civilian, and are using that Act, though he bears it no good-will. We have got most of our forests demarcated, and many settled, but perhaps you are not aware that there has been any difficulty about that. If Government had allowed the work to be done by Forest Officers it would have been finished about ten years ago. But even in the Act itself is the trail of the serpent. Any person *except* a Forest Officer is to be Forest Settlement Officer, and most of us can tell what dire uphill work it has been to keep the Revenue Officers up to the scratch. The interminable delays, the strenuous efforts to "protect" (*i.e.*, *destroy*) what should be

"reserved," the determined claims to every imaginable species of popular privilege, the denunciations of the Forester as the incarnation of harsh grasping oppression, and the pooh-poohing of his arguments, all these we have lived and fought manfully through.

What have we done! We have educated our masters! We have taught our lately unwilling, jealous, inimical superiors, the local Government and their shrewd civilians, to respect and adopt, to believe in, and to begin to loyally support, the science we represent. The "shrewd junior civilian," who is cock sure he could do much better without us, is unfortunately not yet extinct; but his vitality is sapped, and we fear him no longer. Even the Bombay Government, under the paternal but needful eye of the Government of India, is beginning to see the error of its ways. Call you this nothing? Faith! I, as having borne a small share in the battle, am proud of it.

Do you demand revenue? Enquire how many times the revenue of 20 years ago will go into that of to-day. Do you want books? Take down Brandis, Gamble, Schlich, Macgregor, Baden-Powell, or one of your own, and others which you know more about than I do. As for Working Plans, I am sure you have piles of them in your records. Is it organization you seek? What was the state of things 20 years ago, and do we owe our present position to civilians, or to the pertinacious and unremitting efforts of our own officers? True, we may be a little backward in cultural knowledge, but you are speaking on the assumption that we have been in cultivation and peaceful enjoyment of well regulated forests for the last 20 years, whereas the actual fact is, that we can even yet hardly call our souls and lands our own. Look at the amount of administrative work we have to do, and remember that the arts of peace can only flourish on the successful issue of the arts of war. The urgency of the present is the art of war. Every battle lost now is lost for ever. Cultural matters can wait till we can spare time for them without neglecting vital interests. I maintain there is not a department in India that can show such a glorious record. Others have made as much progress perhaps, but which of them has had to fight its way step by step through the passive inertia, the active dislike, the opposition, contumely, slander, general unpopularity, and agitations that we have withstood, and now stand fairly abreast of them all—the best-abused and least encouraged department in India. Long may we so stand—self-reliant, fearless, and single-minded to the end of time.

VELLEDA.

Dr. SCHLICH'S TEACHING RE FORESTRY, GRAZING AND RAB.

A REFERENCE to the Administration Reports of the Circle in which I have the honour to serve shows that the revenue from grass and grazing in 1887-88 was 2½ lakhs, while grass and grazing of an equal value was "appropriated by concessionaires." The corresponding figures for 1888-89 are Rs. 3¼ lakhs and Rs. 2½ lakhs respectively. These figures show incontrovertibly, I think, that from either the Government or the consumer's point of view the question of grazing in its connection with forestry is a most important one, and I have no doubt that it is equally so in many other circles. I turned to Dr. Schlich's Manual to see what is being taught to the "*conscrit*," whom I expect to join us next season. As far as I can discover, after searching that book from cover to cover, the only reference to the subject is to be found in nine lines on page 225, headed "Forestry combined with the rearing of cattle." I would like to see the face of the District Forest Officer, Thana, on finding a fine growth of sissu saplings cut over to feed a "Dhangar's" herds, or the District Forest Officer, Khandesh, gazing on a few acres of pollarded Hardwickia saplings when our conscrit comforts him from the manual with "Broad-leaved species may also be lopped for cattle fodder." "The trees should be placed in lines." Really, I believe, the Principal Professor is chaffing. Now, Mr. Editor, I understand that it is expected that the Forest Class at Cooper's Hill will in time furnish foresters not only for the colonies but for England itself; and in view of such a contingency, I have no quarrel with Dr. Schlich when he teaches that the production "of trees and shrubs of special beauty" may be a possible "object of management," but I must confess my disappointment at the way all special questions of Indian Forestry are shelved in the manual, which is meant, at any rate primarily, for the education of the coming generation of Indian Foresters. —

In this Western Presidency again "Rab" is a 'burning question'—('Rab' is the loppings of trees burnt annually on the rice nurseries of the Konkan), and is answerable for very much denudation of hill slopes). There is ample literature on the subject, including the evidence of Forest Officers and others before the Thana Forest Commission, which must have been available to Dr. Schlich. But Rab is never mentioned, and its elder sister, "Kumri," is dismissed in ten lines, with a pat on the back rather than otherwise. But in connection with Rab I have a far graver charge than one of mere omission to bring against Dr. Schlich.

At page 213, he writes: "After severing the whole or part of the stem above ground the roots and stool develop shoots, thus producing a new generation. This process of regeneration can, as a rule, be repeated *as long as the stool and roots continue to live.*" Again, at page 214, after describing "pollarding," he concludes with: "In either case the trees may be cut over *just as in ordinary coppice.*" (The italics are mine.) If the theory here enunciated is true, we have been living in a Fool's Paradise, and pure coppice working is bad Forestry, for it is *not* a regeneration of the crop, but a mere harvesting of material which can only be repeated a certain number of times, *i.e.*, "as long as the stool continues to live," and must inevitably end in denudation. But the theory is false. If coppice is properly worked, the shoots develop independent roots and become independent trees, capable of being themselves coppiced. It is this fact which makes the coppice system a system of "natural regeneration." The point is a vital one in connection with Rab, for (according to Dr. Schlich's teaching) the rab-cutter, who merely lops the trees, is right, and the Forest Department, who wish to restrict him to branch-wood produced from coupes of coppice, is wrong. For if the permanency of the crop depends solely on the life of the original stools and shoots, it is evident that mere lopping must be less of a shock to the constitution of the tree than felling "*rez terre*," and consequently must tend less to shorten the life of the tree and therefore of the crop.

GHATI.

BRANDY FROM WOOD.—An eminent German sanitary expert says that chemists have succeeded in making a first-rate brandy out of saw-dust. A man can, therefore, get a rip saw and go out and get as drunk as a lord on a fence rail. A man can make brandy smashes out of the shingles of his roof; he can get *delirium tremens* by drinking the legs of his kitchen chairs. You may shut an inebriate out of a gin shop and keep him away from a tavern, but if he can become uproarious on boiled saw-dust and desiccated window sills, any attempt at reform must necessarily be a failure, and we think that the opinion of a sanitary crank upon the jim-jams of a house should be taken with a most liberal grain of allowance.

II. Review.

A MANUAL OF FORESTRY.

By William Schlich, Ph. D.*

Probably it will not for some time be generally recognized in England that forestry is a profession in the sense in which we speak of the profession of law or of medicine. And it is a bold step to publish a manual of forestry for English readers in a systematic and strictly technical form. This is the task which Dr. Schlich has undertaken, and the volume before us is the first instalment of a large work, which, when completed, will be the first comprehensive manual of forestry in the English language.

Before going out to India in 1866, Dr. Schlich had passed the examinations for the superior forest service in his own country (Hesse Darmstadt), he had been the pupil of one of the most eminent Professors of Forestry in Germany, the late Gustav Heyer, and he held a distinguished place among his fellow-students. At the commencement of his career, the changes which had taken place in Hesse Darmstadt in consequence of the Austrian war were believed to affect injuriously the chances of promotion for the younger members of the forest service. This induced him to accept the offer of an appointment in India. Here he was designated at an early date for important positions, and thus, after he had served several years in Burma, he was sent to Sind, where, under completely different conditions of climate and forest, he did excellent work. He served successively as Conservator of Forests in Lower Bengal and in the Punjab, until he rose to the post of Inspector-General of Forests. In 1885 he consented to relinquish his important position in India, in order to become Professor of Forestry at the Forest School which it had been decided to form in connection with the Royal Indian Engineering College at Cooper's Hill.

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* Vol. I. (London: Bradbury, Agnew, and Co., 1889.)

We hope shortly to publish our own review of this work, but in the meantime reprint what Sir D. Brandis has said of it in *Nature* of 12th December, 1889. Sir Dietrich has himself supplied us with "copy."

The volume before us contains the general and introductory part; in a second volume the author proposes to set forth in detail the different sylvicultural operations; while the protection of forests, the utilization of timber and other forest produce, the systematic arrangement of the plans for working, and the financial aspect of forest management, will complete the work. Not the least of the advantages which will be gained by the publication of this manual will be to settle the English forest terminology. The technical terms which had been tentatively used since methodical forest management was begun in India may now be expected to receive general currency, and will be more correctly understood than before.

The primary object of the Cooper's Hill Forest School is the training of officers for the Indian Forest Service, but others also may attend the forestry classes in order to qualify for the management of forests and woodlands in Great Britain and in the colonies. It may therefore be hoped that Dr. Schlich's manual will eventually promote the good management of forests in many parts of the world. In Great Britain and Ireland the author states the area of woods and forests at 2,790,000 acres, and in British India the area of Government forests at 70,000,000. No data are available for estimating the forest area in the British colonies. But the area stated is sufficient to demand the systematic teaching of forestry in England.

In the German Empire the total forest area only measures 34,346,000 acres, of which 11,243,000 acres belong to the State. Yet there are no less than nine forest schools in the different States for educating the superior officers in the State and other public forests and the principal wood managers in private estates. The books published on the subject of forestry in all its branches during the three years 1886-88 amounted to 177, or fifty-nine a year on an average. Besides these, there are ten periodicals on forestry, some quarterly, most monthly. One general association of German Foresters meets annually, and ten local societies hold their meetings either annually or once in two years. And all these associations publish their transactions. Perhaps it will be urged that this large and daily-growing forest literature is not necessarily an advantage; that German foresters had better attend to the management of their forests instead of writing books. As a matter of fact, however, the management of the German forests, public as well as private, is excellent, and is improving steadily. The best proof of this is the large and steadily growing income derived from these estates by the Government, by towns and villages, and by

private proprietors, and, more than that, the improved condition and the increased capital value of these properties.

A commencement, however, of forest literature has been made in the English language. The Transactions of the Royal Scottish Arboricultural Society have attained their twelfth volume, and they frequently contain papers of considerable importance. The *Indian Forester*, commenced as a quarterly by Dr. Schlich in 1875, is now a monthly magazine, of which fifteen volumes have appeared. In addition to these a number of valuable publications on different branches of forestry might be named that have been published within the last twenty-five years.

German forest literature, though it has attained such large dimensions, is of comparatively recent origin. During the eighteenth century sylviculture and the management of forestry had made great progress in many parts of the country, but the methodical and scientific treatment of the subject dates from the labours, during the first thirty years of the present century, of Hartig in Prussia, Cotta in Saxony, and Hundeshagen at Giessen. Scientific forestry in England must necessarily be built upon what has been accomplished in this respect in Germany, and with becoming modesty Dr. Schlich acknowledges that the principal German works have been his guide in the preparation of the present book. Great Britain does not stand alone in this respect. In France also the development of scientific forestry has to a great extent been based upon the progress previously made in Germany. The same may be said of forestry in Italy, Russia, Scandinavia, and other European countries.

Part I. of the manual treats of the utility of forests directly in producing wood and other forest produce and indirectly in influencing the climate, in the distribution of rain-water, in the preservation of the soil on sloping ground, in the binding of moving sands, and in affording shelter against winds. All these matters are clearly and exhaustively treated, and in regard to the climatic influence of forests the author gives a most useful summary of the researches which have been made to determine the effect of forest growth upon the temperature of air and soil, rainfall, humidity, and evaporation in Germany, Switzerland, and France, mainly by the establishment of parallel stations, one being situated inside a fully stocked forest and the other at some distance in the adjoining open country.

Part II. sets forth the fundamental principles of sylviculture. The author maintains, with justice, that the principles of sylviculture hold good all over the world, but adds that the illustration

of these principles must be taken from a limited area. For this purpose he has chosen the timber trees of Western Europe on the 50th degree of north latitude, and the countries immediately to the north and south of it—in other words, the forest trees of England, Northern France, and the greater part of Germany. These species the author does not attempt to describe; he assumes that his readers are familiar with them. The first chapter dwells upon the external conditions which influence the development of forests. He says:—

"Soil, including subsoil, and atmosphere are the media which act upon forest vegetation, and they together are in sylviculture called the 'locality.' The active agencies, or factors, of the locality depend on the nature of the soil and the climate, the latter being governed by the situation. The sum total of these factors represents the quality or yield-capacity of the locality. The Forester requires to be well acquainted with the manner in which soil and climate act on forest vegetation, in order to decide in each case which species and method of treatment are best adapted, under a given set of conditions, to yield the most favourable results."

Every forester knows that on good soil, and under conditions otherwise favourable, a timber crop is heavier than one of equal age grown under less favourable conditions. In the concluding section of this chapter the author shows how one may use this fact in order to assess the quality of a locality. Numerous measurements of woods of different species and ages, grown under different conditions, have been made in Germany on a systematic plan, and from the data thus obtained yield-tables have been calculated, showing the volume of timber produced at different ages on a given area by the principal species on localities of different quality classes. Using the yield-tables published for the Scotch pine by Wilhelm Weise, now Professor at the Forest School of Karlsruhe, the author shows that at the ages of 50 and 120 years the volume per acre of timber only, not including faggots, in localities which, according to their yield-capacity, are classed as first, second, and third class, is as follows:—

	I.	II.	III.
Cubic feet at the age of 50 years, ...	5,060	3,940	2,700
" " " 120 " ...	9,060	6,950	5,340

The figures of these yield-tables Dr. Schlich has found to a certain extent to be applicable to Scotch pine forests in England. They can therefore be used in order to assess the yield-capacity

of any locality stocked with Scotch pine. Eventually, similar yield-tables will doubtless be prepared for the Scotch pine and other forest trees in Great Britain, and it will then be possible with certainty to say what yield of timber may be expected from plantations made in a certain locality.

The second chapter deals with the shape and development of forest trees, but we can refer only to what the author says regarding height-growth. Building again chiefly upon researches made in Germany, Dr. Schlich explains how the different species have a different mode of height-growth. On p. 163 an instructive diagram will be found exhibiting the relative height-growth of spruce, silver fir, beech, and Scotch pine in a locality of the first quality. At the age of 50 years the mean height attained by each species is as follows :—

Scotch pine, ...	64 feet.
Beech, ...	60 „
Spruce, ...	55 „
Silver fir, ...	40 „

At a later age spruce and silver fir take the lead, while beech and Scotch pine remain behind in the race ; and when 120 years old, the order of the species stands as follows :—

Spruce, ...	188 feet.
Silver fir, ...	108 „
Beech, ...	102 „
Scotch pine, ...	97 „

Scotch pine and beech therefore make the principal height-growth during the first period of their life, whereas spruce and silver fir continue to grow vigorously in height to a much greater age, spruce more so than silver fir. The progress of height-growth of the different species is much affected by the character of the soil, by elevation, the more or less crowded state of the wood, and other circumstances, but under otherwise similar conditions it will always be found that deep, fresh, fertile soil produces much taller trees than shallow, dry, or rocky soil.

In the third chapter, which deals with the character and composition of woods, the author points out that the object of sylviculture is not to rear isolated trees, but considerable masses of trees, forming more or less crowded woods. Pure woods consist of one species only, or of one species with a slight admixture of others, whereas mixed woods contain a mixture of two or more species. The advantages of mixed woods are clearly set forth, and the

author's remarks on this subject may be specially recommended to the attention of proprietors and managers of woodlands in Great Britain.

The last and most important chapter deals with the sylvicultural systems—that is, the different methods under which the creation, regeneration, tending, and utilization of woods are effected. The three well-known classes are: first, high forest, originating either self-sown or artificially raised; second, coppice, which regenerates itself from coppice shoots; and third, coppice with standards, a combination of seedling and coppice forest. The modifications of these three main systems are numerous, and particularly the treatment of high forest has developed in a great variety of ways. On this subject we must refer the reader to the manual. These are matters which can hardly be fully understood without opportunities for obtaining practical experience of forests treated under the various systems described. Such opportunities may, to some extent, be found in Great Britain. The high forests of larch and Scotch pine in Scotland, raised by planting, are excellent, and in some districts Scotch pine woods are regenerated by self-sown seedlings. The oak woods of the Forest of Dean and the beech woods on the chalk downs of Buckinghamshire are instances of high forests with different character and different methods of treatment. Most instructive, again, are the natural oak forests in Sussex-coppice, with a large proportion of standards. So are the coppice woods of ash and sweet-chestnut for the production of hop-poles in Kent, and the osier beds on the banks of the Thames. The difficulty is, that the treatment of these woods is entirely empirical, and that without authentic statistical data regarding yield in timber, regarding income and outlay, no forest can properly be used for purposes of instruction. If the student wishes fully to understand this and other portions of the excellent manual before us, he must study the forests of Germany, public and private. This may be a disadvantage, but under the circumstances of the case it cannot be helped.

Appended to the first part of the book are two treatises which will be read with interest by those who may not care to study the more technical portion of the manual. They deal with forestry in Great Britain and Ireland and in British East India. The physical configuration of India, its climate and rainfall, the distribution of the forests, and the forest policy pursued by the Government of India during the last thirty years are clearly set forth. The protection and systematic management of its forests are matters of the utmost importance for the welfare of the millions inhabit-

ing the British Indian Empire, of infinitely greater importance than good forest management is for Germany or other countries of Europe. Enthusiastic Foresters in India have long maintained that by improving the condition of existing forests, so as to make them more dense and compact, by extending their area, and by creating forests where none exist at present, the rainfall in seasons of drought might be increased, and famines might thus be averted. Dr. Schlich fully discusses this subject, and states several cases in which the presence of dense forest growth seems to accompany an increased rainfall; but at the same time he fully explains the reasons why a final conclusion does not seem justified. The result is that, though the local influence of forests in lowering the temperature and preserving moisture is undeniable, we are not justified in hoping for an improvement of the Indian climate. The favourable influence of forests in India upon the irrigation from wells and tanks is, however, beyond doubt, and this is a vital question.

To illustrate the effect of forest growth in protecting loose soil on hill-sides, the author mentions the Siwalik Hills at the foot of the North-West Himalaya. We quote his words:—

"Anyone who has ever stood on the hills behind Hoshiarpur in the Punjab and looked down upon the plain stretched out towards the south-west has carried away an impression which he is not likely to forget. In that part the Siwalik range consists of an exceedingly friable rock, looking almost like sand baked together. Formerly the range was covered with a growth of forest vegetation, but a number of years ago cattle-owners settled in it, and under the combined attacks of man, cows, sheep, and goats, the natural growth disappeared, while the tread of the beasts tended to loosen the soil. The annual monsoon rains, though not heavy, soon commenced a process of erosion and of carrying away the surface soil. Gradually small and then large ravines and torrents were formed, which have torn the hill range into the most fantastic shapes, while the *débris* has been carried into the plains, forming, commencing at the places where the torrents emerge into the plain, fan-shaped accumulations of sand, which reach for miles into the plain, and which have already covered and rendered sterile extensive areas of formerly fertile fields. Indeed, one of these currents or drifts of sand has actually carried away a portion of the town of Hoshiarpur. The evil has by no means reached its maximum extent; and if curative measures are not adopted at an early date, the progress of transporting the hill range into the plain will go on, until the greater part of the fertile plain stretching away from its foot has been rendered sterile."

The author might have added the denuded hills, and the rivers, formerly navigable, but now silted up, in the Ratnagiri district of Western India, and other similar instances.

That a country so populous as India requires immense quantities of timber, bamboos, and firewood goes without saying. Among other articles of forest produce, cattle fodder is an important item. In the drier portions of the country the supply of grass, particularly during seasons of drought, is more plentiful under the shelter of trees than out in the open. In times of scarcity grain can easily be carried long distances to provide food for the people, while cattle fodder cannot be so easily carried. As a matter of fact, where forests have been formed and protected in the drier parts of India, they have proved a great help in enabling the people to maintain their cattle in times of drought and scarcity.

In India the duty of taking action necessarily devolved upon the State. The result has been the formation of extensive forest estates, called reserved forests, which at present, the author states, aggregate 33,000,000 acres, or three times the area of State forests in the German Empire. If forest matters in India continue to be properly managed, these estates will not only secure the well-being of the people, but will be an important source of strength to the Government, financially and otherwise. As yet the revenue which they yield is insignificant in relation to their extent. But it is growing steadily. Dr. Schlich shows that during the three years 1864-67 the average annual net revenue from the Government forests amounted to £106,615, and during the five years 1882-87 to £384,752 ; and he states it as his opinion that twenty-five years hence the net surplus will be four times the present amount. More important, however, than the annual revenue is the steadily increasing capital value of these Government forest estates.

In Great Britain the aspect of affairs is different. The small area of the Crown forests, burdened as they are with prescriptive rights, cannot reasonably be expected materially to help the development of systematic forest management. But there are over 2,500,000 acres of woods and forests in the hands of private proprietors, and there are 26,000,000 acres of barren mountain land and waste, a portion of which might be planted up. Proprietors, as a rule, desire to augment their income and to increase the capital value of their estates. In many cases this might be effected by a more systematic management of their woodlands, and by the planting up of waste lands. The chief obstacle to progress in this direction is the low price of timber and the high rent at present obtained by the letting of grouse moors and deer forests.

Upon data which cannot be gainsaid, Dr. Schlich has based important calculations, which will be found on pp. 17–19. Space forbids the discussion of details, but the result is that Scotch pine forests cannot be expected to yield more than 2½ per cent. on the capital invested (the value of the land and of the growing crop).

"All land, therefore, which can be let for the raising of field crops, for shooting, or other purposes, at a rental equal to, or upwards of 2½ per cent. of the capital value of the land, had better be so let. On the other hand, land which would realize a rental of less than 2½ per cent. of its value may with advantage be planted with Scotch pine or other similarly remunerative trees."

These conclusions are based upon circumstances as they exist at the present time. But a change of circumstances is not impossible. The author points out that 6,000,000 loads of timber are imported annually into the United Kingdom from Europe and North America, and that only a small portion of the forests which furnish this large supply are under systematic management and control. It may be regarded as certain that the supply from Sweden and Norway and from North America, amounting at present to nearly 4,000,000 loads a year, will continue to diminish, and, under the circumstances of the case, the necessary result of such diminution will eventually be a rise in the price of timber. Again, if proprietors of woodlands in England and Scotland were in a position to offer large quantities of home-grown timber of good quality for sale, regularly at stated seasons, timber traders would make their arrangements accordingly, and in many cases better prices would be obtained. Firewood is at present almost unsaleable in the United Kingdom, but if—and this may happen—the price of coal should rise considerably, firewood would in some districts become an article of general consumption, as it was 150 years ago, and to some extent this would improve the money-yield of woodlands.

It is not too much to say that the publication of Dr. Schlich's Manual will give a powerful impetus to systematic forest management in the United Kingdom, in India, and in the vast colonies of the British Empire—in fact, wherever the English language is spoken.

D. BRANDIS.

III. Official Paper.

A NOTE REGARDING CERTAIN INDIAN TANNING MATERIALS.

Introductory Remarks.

At a Conference held at the late Colonial and Indian Exhibition in London, a number of gentlemen assembled to examine the Indian tanning materials. Samples were freely distributed among those present for the purpose of securing professional opinions, and, as the result, various reports have appeared in trade and commercial publications. Among these may be specially mentioned the Report issued by the Leather Section of the London Chamber of Commerce. Subsequent to the Conference, applications were received at the Exhibition for collections of Dyes and Tans to be placed in the museums of certain Industrial Institutions. In consequence, letters and reports have been received, which are deemed of such importance as to justify a selection of papers on certain tanning materials being now published.

While some of the Indian tans have, as indicated, been subjected during the past year or so to industrial and chemical examinations, other practical experiments have been set on foot by the various Governments of India. *Divi-divi* has been grown in Bombay, of which the samples sent to England have been highly commended. Information has also been collected regarding *Acacia* bark and pods of so extensive a nature that a large volume might be issued on that subject alone. Captain Wood, Conservator of Forests, North-Western Provinces and Oudh, has carried out useful enquiries into the preparation of Tanning Extracts.* That officer was one of the first to recognize that there were other woods and barks besides catechu that might be boiled down to conveniently exportable extracts. Samples of the extracts prepared by him were shown at the Conference, and the idea of utilizing new tanning materials was thoroughly approved of. It was deemed unnecessary to endeavour to prepare cutch from such trees as *Acacia Suma* and *A. Sundra*, since these are even less abundant than *A. Catechu*, and consequently their extracts could not be prepared at a cheaper rate than the cutch so largely made in Pegu and Kumaon. It

* We have already given the results of Captain Wood's enquiries in Vol. XV., pages 51–55.—[Ed.]

was not, in fact, considered necessary that cheap cutch should be the sole aim of the exploration for new tans. There are many astringent substances rich in tanning materials, and it was recognized that the search became one for a cheap article that would not impart much colour, while possessing a fairly good proportion of some tanning principle. The colour which cutch gives to the leather is the chief r ason why gambier is preferred by English tanners; but the Kumaon cutch, which at the Conference was mistaken for gambier until its character was explained, was by most of those present examined with apparent interest. The following extract from the Report of the Conference may be here given, since it refers to this and one or two other points of importance in connection with cutch :—

"At the present day cutch is not much used by tanners: it is too expensive, and the leather made by its means exudes an objectionable salt. Gambier is, therefore, preferred. Catechu bark, however, was pronounced one of the best barks shown. It seemed to possess a large amount of tanning principle, and had the equally indispensable property of being pale-coloured.

"A very extensive collection of samples of the extract having been shown, a discussion took place with regard to the Kumaon form. Mr. Proctor and several other gentlemen present had never seen this before, and thought it likely to possess properties which the tanning industry had overlooked. Samples were distributed, and reports promised. Some of the redder and less gummy forms of Pegu cutch were viewed as hopeful from a tanner's point of view.

"It was urged that what had been done with the *Acacia Catechu* should be tried with a large number of other trees. The opinion seemed to be that many plants which had been neglected would yet come to yield preparations similar to cutch, and possibly cheaper, through being prepared from more abundant trees.

"The cutch obtained from *Acacia Sundra* was viewed more as a curiosity than anything else. Chemically, it is the same substance as the ordinary cutch; and since it is believed the tree is not so abundant as *Acacia Catechu*, it was thought undesirable to dwell further on this substance, except as an additional source of cutch. It was pointed out that the difficulty in using cutch as a tanning material was the fact that it imparted a pronounced colour to the leather, which was not always desirable."

Acacia Catechu Bark.

(*Conf. with Dictionary Economic Products*, Vol. I., p. 27.)

The opinion was unanimously expressed, that much valuable

material had been for years destroyed through the bark of the cutch tree not being utilized. The pale colour of the bark and its apparent richness in tannin were characters that seemed to warrant high expectations that an extract of the bark, or even a carefully dried powder, would find a ready market. This seems, therefore, a subject that might with advantage be commended to the Cutch makers. An experiment or two might indeed be undertaken by Government to ascertain the cost of producing a bark extract or a bark powder. It is possible that the expense of boiling down the bark might not be repaid by the price obtained. But this is a point that could only be solved by careful experiment; and if it proved to be not sufficiently remunerative, attention might then be turned to the preparation of a powder from the rejected bark similar to the powdered pods of *Acacia arabica*, an article which may now be said to have found a distinct market. (*Conf. with p. 107.*)

ACACIA ARABICA.

(*Conf. with Dictionary Economic Products*, Vol. I., p. 18.)

The following passage from the Report of the Conference (Colonial and Indian Exhibition) regarding *Acacia arabica*—the babúl or kikar—may be viewed as instructive :—

"The gentlemen present were of opinion, that if it were possible to induce some Indian firm to prepare from the pods an extract similar to cutch, a trade might be started in this product. The difficulty in the way of opening up trade in tanning materials was one of freight. It is essentially necessary to reduce tanning materials to their smallest possible bulk and weight; and the opinion was given that much could be done in this direction by ascertaining how far it was possible to produce extracts, either in a dry condition like cutch, or in the form of a liquid or prepared powder.

"It was suggested that it would be preferable to keep the preparations of the bark distinct from the pod; and in preparations of the pod it was recommended that, if possible, the seeds should be rejected, as they would be injurious. Dr. Watt drew attention to the fact that in a recent communication from the Berlin Leather Trades Association fresh interest had been created in the *Acacia* (or babla) pods, owing to the light grey colour they impart to sheepskin."

It seems possible that simple machinery might be designed to crush the dry pods and remove the seeds. By so doing, the value of the tanning material would be greatly enhanced, at the same time that a large quantity of a useful cattle food would be secured. Indeed, the value of the pods as a tanning material is greatly depreciated through the action of the weevils that literally riddle the

pods in order to reach the seeds. In the correspondence published on a further page regarding *Divi-divi* (page 102), Messrs. P. and S. Evans & Co. make the suggestion that the Australian *A. pycnantha* should be introduced into India. There would seem little to justify the conclusion that this would succeed better than the common babúl, unless it be established that the Australian plant is so much superior from a tanner's point of view as to justify a special effort being made. Regarding the peeling of babúl bark *see* the remarks at page 106.

ACACIA LEUCOPHLŒA.

(*Conf. with Dictionary Economic Products*, Vol. I., p. 25.)

The bark of *Acacia leucophlœa*—the reru or safed-kikar—attracted attention at the Conference; and the leathers exhibited from various districts in India as prepared by means of this material were considered superior to any others shown. These facts would seem to suggest the desirability of having experiments instituted with a view to determine the price at which an extract from this bark could be sold and the annual quantity likely to be available. But just as with the bark of *Acacia Catechu* it might be found that it would not pay to extract the tannin, in which case it would become necessary to experiment with the production of a dry powder. The writer has no personal or practical acquaintance with the preparation of tanning extracts. A suggestion may, however, be here offered (and this occurred to him when the superiority in point of colour of *Acacia Catechu* bark as compared with the extract cutch was under discussion at the Conference)—*viz.*, may it not be that the act of boiling down the chips of wood causes chemical changes by which the colour is produced? If this be so, then extracts from these barks might prove less valuable than the pulverized bark itself. But here, again, we are confronted with the necessity of careful experiments.

ANOGEISSUS.

(*Conf. with Dictionary Economic Products*, Vol. I., p. 256.)

The bark and leaves of the *Anogeissus latifolia*—the dhává or dháurá—and the leathers tanned by these were exhibited at the Conference. The following passage from the Report may be here given:—"It was explained that these materials were extensively used in India, and that if found suitable for the European market, they could be more cheaply and extensively supplied than perhaps any other tanning substance found in India. The casual examination, however, seemed to suggest that, unless these could be prepared in the form of a condensed extract or fine powder, they were

never likely to find a market in Europe. To export a large quantity of dried leaves appeared undesirable, the bulk and danger of ignition being almost prohibitive."

CASSIA.

(*Conf. with Dictionary Economic Products*, Vol. II., p. 215.)

The leather tanned by the bark of *Cassia auriculata*—the tarwar—was considered at the Conference much superior to what could have been inferred from the examination of the highly coloured bark. It was suggested that the same experiments should be tried with this substance as had been proposed in the case of *Acacia Catechu, viz.*, to prepare an extract and also a powder, and to furnish particulars as to the amount that might be annually available and the prices at which these preparations could be placed on the home market. The same opinion was expressed with reference to the bark of *Chickrassia tabularis*—the Chittagong wood or chikrássí pabha, &c.—*viz.*, that unless it would pay the Indian dealer to prepare an extract for the purposes of exportation, it would be hopeless to expect this, or in fact any crude bark, to bear the freight and other charges so as to compete with the materials at present being placed in the home markets.

EMBLICA MYROBALAN.

(*Conf. with the remarks at page* 92.)

A few of the tanners present were familiar with the Emblic myrobalans—the fruit of *Phyllanthus Emblica*—daula, ámla, aonla—though they had never before seen the leaves. But the same objection exists with regard to these as has already been alluded to under *Anogeissus*. Unless a tanning half-stuff could be profitably prepared for export, it would be hopeless to expect a trade to be done in the leaves. They are doubtless good and useful tans, but have to compete with others that can be landed in the home markets at lower prices. This argument seems perfectly just and applicable to the leaves, but since it pays to export the fruits of the true myrobalans, it would seem as if the question of a future trade in the Emblic myrobalan would turn on the percentage of tannin which it possesses and the colour it imparts to the leather.

SOYMIDA BARK.

In the Report of the Conference it is stated that the bark of *Soymida febrifuga*, the rohan tree of Hindustan and the shem of South India, "gained most favour of any of the tans shown at the Conference. The high amount of tanning principle which it seemed

to contain, when taken along with the pale colour of the material, gave promise of an almost certain future. It was accordingly strongly recommended that experiments should be made with this tan in preference almost to any other." With the possible danger of a limitation of the supply of cutch which the greatly increased demand for that extract is causing, it was recommended by the gentlemen assembled at the Conference that an effort should be made to discover a good substitute ; and although these gentlemen urged that several plants should be experimented with in order to discover a good cutch substitute, the rohan met with the highest commendations. And it may be remarked that even were it found to be as convenient to extend the cultivation of *Acacia Catechu* itself as to adopt a substitute, it was urged there were drawbacks against cutch which would justify the experiments suggested.

New Tanning Extracts.

In the preparation of extracts by Captain Wood, to which incidental reference has been made, and of which the Inspector-General of Forests has been good enough to supply this office with a copy of the correspondence, the sál (*Shorea robusta*) and the Asna (*Terminalia tomentosa*) are the trees being experimented with. The former has long been known to afford a strong tanning material ; and the latter, while belonging to a family the fruits of which are known to tanners as myrobalans, has not obtained the same reputation as that of the sál. Its fruits are so inferior to those of *T. Chebula*, the true myrobalan, that they are not even used as an adulterant in the preparation known to the trade as "ground myrobalans." At the same time the Asna bark is rich in tanning materials, and thoroughly deserves to be carefully investigated. In a further paragraph the subject of Captain Wood's experiments will be reverted to ; but meantime it may be added that, when opportunity occurs, it would be desirable to have the same experiments performed with all the barks, fruits, and leaves, to which reference has been made in this brief review of recent investigations with Indian tanning materials. Captain Wood, however, advances an argument (in favour of the trees now under his examination) which is so powerful as to scarcely admit of any difference of opinion. These trees are abundant in certain forests that are being cut up by railway extensions. Immense quantities of the bark are thus likely to be completely destroyed, if not utilized in the manner proposed.

(*To be continued*).

IV. Notes, Queries and Extracts.

Forestry in the Colonies and in India.

(Continued from page 285).

As long as the sea winds are sufficiently strong to keep in check, and even force back, the north-western winds, all is well for India; but occasionally the reverse occurs—that is to say, the north-west winds force back the sea winds, and proceed far into the Indian plain and the Peninsula. If this ascendency continues for some time, the rains fail, and scarcity or even famine is the result.

In September the monsoon commences to decline, and by degrees north-easterly winds replace the south-western and southern breezes. They are dry, except in parts of Madras, where they bring heavy rain until December, and are known as the north-east monsoon winds. Local rains of moderate extent are caused during winter, more especially in the Punjab and North-Western Himalayas.

The total annual rainfall ranges from 4 inches in some parts of Sind to more than 500 inches in the Khasia Hills, and all intermediate grades are duly represented.

A country which shows such extremes of climate must necessarily show a most varied vegetation. The actual distribution of the forests is principally governed by the rainfall. Where that is favourable, production is great, and the forests are dense; where it is unfavourable, production proceeds at a slow rate. Again, the nature of the rainfall governs the character of the forest. Where the rains are heavy, the country is generally covered with evergreen forest; where it is less copious, the forests are deciduous; under a still smaller rainfall, they become sparse, and more dry, until they gradually end in desert. Consequently, the evergreen forests are found along the moist west coast of the Peninsula, in the coast districts of Burma, Chittagong, and along the foot and lower slopes of the Eastern Himalayas. The deciduous forests occupy the greater part of the Peninsula, and Burma away from the coast. Dry forests are found in Rajputana and the Punjab, while deserts are the principal feature of Sind.* With rising elevation in the hills, the forests become gradually temperate, and then alpine, until

* Sind has some very valuable forests, which are situated on the banks of the Indus on land more or less regularly inundated.

they disappear altogether on approaching the lower limit of the eternal snows.

I have dwelt in some detail on the great variety of climates prevailing in India, because some idea on the subject is necessary so as to understand the forest policy which is indicated in the case of that country. The main issues of that policy depend on the following three points :—

(1). Forests in relation to climate and rainfall,

(2). The regulation of moisture, and

(3). Forest produce required by the country.

However much may have been written and said on the first point in its application to India, I can, in the present state of our knowledge, dismiss it in a few words. The south-west monsoon must for ever be the main source of moisture in India, and the climate and rainfall of the Indian plain and of the Peninsula are generally subject to other influences, in comparison with which the effects of forests must always remain small. On this account, then, afforestation cannot be pushed in the case of India. I must, however, not omit to mention that the shade and shelter of forests will be most gratefully accepted by man and beast in a hot country like India.

I have something more to say under the second head. In a tropical climate like that of India the evaporation from an area exposed to the full effects of the sun is probably not less than four times that from an area which is covered by a dense growth of forest vegetation ; hence afforestation is of great importance wherever the rainfall is limited or unfavourably distributed over the several seasons of the year.

Then, there is irrigation to be considered. No less than 30,000,000 acres of land are artificially watered in India by means of canals, wells, lakes, and tanks. Only 3,000,000 acres depend directly on the melted snow of the Himalayas, and it will easily be understood of what importance it is to keep the areas which provide the remainder of the water properly sheltered. The larger the proportion of the catchment areas, whence the irrigation water comes, is shaded by forest vegetation, the more favourable and sustained will be the supply of water. On this account, then, forestry in India has an important mission to fulfil.

The mechanical action of forest in regulating the flow of water from hill sides, also, is not without importance in India, and cases are by no means rare which show the mischievous effect of reckless deforestation. In this respect none is more instructive than the case of the hills behind Hoshiarpur, in the Punjab. These, consisting of a friable rock, were safe, until, some forty years ago, cattle

graziers settled in them and destroyed the forest and other vegetation. Since then a process of erosion has set in, which is carrying by degrees the hills into the plains, where they appear as huge sand drifts, which have already covered enormous areas of fertile cultivated land, and even destroyed part of the town of Hoshiarpur. Such an evil can be avoided by preserving the natural vegetation on the land ; but, if once started, special measures are required to meet it. In the first place, grazing must be stopped, at any rate that of goats and sheep, so as to allow a natural growth of plants, shrubs, and trees to come up ; artificial sowing and planting must be done, preceded in bad cases by the construction of dams and dykes to steady the soil, until vegetation has once more laid hold of it. Mischief of this kind can be stopped and cured at a comparatively small sacrifice, provided it is taken in hand at an early stage ; but if it has been allowed to grow for a series of years, the expenses of checking the evil may be beyond the means of the State. As an example, I may here mention that France has been spending large sums of money during the last twenty years in order to cure the mischief wrought in the French Alps in consequence of former neglect and recklessness. This should be a warning to India and the Colonies.

Although forests are of considerable importance in India in respect of their action as regards the regulation of moisture, they are absolutely indispensable on account of the produce which they yield, since by far the greater apart of India must rely on the timber and fuel produced in the country, apart from other produce. All the teeming millions of India use wood fuel for their domestic firing, or, if such is not available, dried cowdung, the latter being much to be deprecated from an agricultural point of view. At the same time enormous quantities of timber are required for construction, boat-building, tools, agricultural implements, railways, and other public works. If we add thereto a demand for many important items of minor produce, more especially cattle fodder in the drier parts of the country, it will easily be understood that at least 20 per cent. of the total area requires to be kept under forest. Even such an area would give only about half an acre per head of population—an allowance below that of most European continental countries.

The history of forestry in India is very instructive. According to the available evidence, the country was in former times covered with dense forests. Then settlers opened out the country along the fertile valleys, but the destruction of the forests on a larger scale was carried out by nomadic tribes, who fired alike hills and

plains as they moved from one pasture to another. This process is believed to have gone on for more than 700 years. Subsequently came British rule, and with it a more fierce destruction of the forests than before. Extension of cultivation became the order of the day, and before its march many of the remaining woods fell under the axe, no inquiry being made as to the ultimate result. Simultaneously with the extension of cultivation and the increase of population, the annual requirements of timber and fuel increased, while quickly multiplying herds of cattle roamed far and wide over the remaining forests. Finally, railways came, and with their extension the forests disappeared with greater rapidity than ever, partly on account of the increased demand for timber used in construction and firewood and partly on account of the fresh impetus given to cultivation on both sides of the lines. I have watched this last process, and I can testify from personal experience how fatal railway extension is to forests which are not subject to proper control and protection.

For some time matters went on smoothly enough in India, but then the shoe commenced to pinch. Difficulty was experienced in meeting the demands of timber for public works, sleepers had to be imported from foreign countries, and it was then recognised that a great mistake had been made in allowing the forests to be recklessly destroyed. Experience had definitely proved that the preservation and suitable management of a sufficient area as forests could not be left to private enterprise, and that the interference of the State had become a necessity in the general interest of the country.

The forest question commenced to attract attention in the early part of this century, in consequence of which a timber agency was established on the west coast of the Peninsula. Next we find, in the year 1843, Mr Conolly, Collector of Malabar, planting teak on a large scale at Nilambur. Dr. Gibson was appointed Conservator of Forests in Bombay in 1847. In 1848 Captain Frederick Conyers Cotton caused the appointment of Lieutenant James Michael (now Major-General J. Michael, C.S.I.) as Forest Officer in the Anamalais, which post he retained for seven years. Dr. H. Cleghorn became connected with forest conservancy in Mysore in 1847, and he was appointed Conservator of Forests in Madras in 1856. He was on special duty with the Government of India about the years 1860-62, when he inquired into the forest matters in the North-Western Himalayas and elsewhere. In the Central Provinces, Colonel Pearson was the first Conservator who took up forestry in a business-like manner.

These gentlemen and others were the pioneers of forest con-

servancy in India. Their action, though localised, caused the matter to be discussed and kept before the public, and it led ultimately to the organisation of a general department by Dr. D. Brandis (now Sir Dietrich Brandis, K.C.I E.). The latter was appointed Superintendent of Forests in Pegu in 1856 by that great administrator Lord Dalhousie. Dr. Brandis was principally instrumental in saving the Burma teak forests from destruction by enterprising timber merchants—that is to say, estates which yield now a gross revenue of some 250,000*l.* a year. In 1862 he was attached to the Government of India, and in 1864 appointed the first Inspector-General of Forests to that Government He then set to work to establish the Indian Forest Department, and to introduce a systematic management of the forests. At first he devoted himself to the provinces directly under the Government of India; subsequently, he was twice deputed to Bombay, and he totally reorganised the Forest Department in Madras in 1881-83, immediately before his final retirement from India.

The first duty of the new Department was to ascertain the extent and character of the remaining forests, and especially of that portion which still belonged to Government. This inquiry was not of special difficulty, except in so far as a sufficiently trained staff was not available at the outset.

The next step was to take the State forests under protection and management, and now difficulties arose. There were, no doubt, some administrative officers who soon perceived that it was to the true interests of the people to preserve a suitable forest area, and who cordially assisted the new Department; but the majority of the officers of the State failed for a long time to accept that view, principally because the idea of forest preservation was new to them, and they feared complications from the facts that the rights of Government in the forests were in many cases ill defined, and that the people claimed extensive rights by prescription and on other grounds in the areas which were the property of the State. The first Indian forest law was passed in 1865: it provided that the Government might declare any land belonging to it a Government State forest, and that such declaration should not abridge any right held by private persons over such areas; but the Act did not provide power to inquire into and legally settle the rights of third persons in the State forests. Under this Act considerable progress was made in the preservation of the forests, wherever the population was limited and the forest areas extensive. But where the reverse conditions prevailed, and where the rights claimed by the people, rightly or wrongly, were extensive, the benefits of the

Act soon threatened to become abortive. Consequently fresh legislation was soon contemplated, and, after years of discussion, a new Act was passed, known as the Indian Forest Act of 1878, followed by special Acts for Burma, Madras, and one or two other provinces. Of these, the Burma Act is the best. Generally speaking, the enactments give power to the Government—

(1). To declare any area belonging to the State, or over which the State has rights, to be a State forest.

(2). To demarcate such area, and to inquire into and settle, once for all, the rights claimed by third persons in or over such area; to commute such rights if they seriously interfere with the maintenance of such forest; and to prevent the springing up of new rights except by a Government grant.

(3). To provide for the proper protection and management of the State forests.

(4). To provide for the protection and management of Government forests not included in the reserved State forests.

(5). To provide for the preservation of private forests, which are of special importance to the community as a whole.

(6). To provide for the protection of forest produce in transit.

(7). To provide for the adequate punishment of persons breaking the forest law.

Passing over many other provisions, I shall only add that the Act is throughout permissive—that is to say, the Government may bring its provisions into operation or not, as may be required from time to time.

Under these laws an area of about 55,000,000 acres, which is just under 10 per cent. of the British territory, have been brought under the control of the Indian Forest Department; thirty-three million acres are so-called Reserved State Forests—that is to say, areas which have been set aside and are managed as permanent forest estates; while the remaining twenty-two million acres are as yet so-called Protected or Unclassed State Forests, enjoying a limited extent of protection until it has been finally decided whether they are to be incorporated with the permanent State forests or not. Some fifteen million acres of additional forest lands are at the disposal of Government, which have not as yet been brought under the control of the Department.

It will be noticed that the area of State forests falls considerably short of 20 per cent. of the total area, the proportion which is believed to be that required to meet the demands of the country. There are, however, as yet extensive forest lands in the hands of private persons, and although their extent and yield capacity is

decreasing every year, a considerable portion is so situated or of such a description that it is not fit for permanent cultivation, and may be expected to yield always a certain amount of produce. Interference with these private forests will only be possible in cases of absolute necessity.

The bulk of the required produce must come from the State forests, and if they are to yield that, they must be managed in a careful and systematic manner. Hence Sir Dietrich Brandis recognised at an early stage the paramount importance of providing a competent staff of officers. He obtained, as early as 1866, the sanction of Government to a scheme, under which every year a number of young Englishmen are selected in this country, and trained in forest science and practice before they proceed to India to take their places as officers of the Forest Department. For many years these young men studied forestry in Germany and in France. Gradually the difficulties of studying in a foreign country and in a foreign language made themselves more and more felt, until it was decided to start, in 1885, an English forest school in connection with the Royal Indian Engineering College at Cooper's Hill. Under these arrangements, some 110 officers have been trained and drafted into the Indian Forest Department. At the present moment we have 22 forest students under instruction at Cooper's Hill.

These young men are destined to recruit the superior or controlling staff of the department. In addition, it was found necessary to let the future executive officers pass through a suitable course of training. Accordingly, an Indian forest school was started, in 1878, at Dehra Dun, in the North-Western Provinces, which has been gradually developed, so that it now turns out annually some 30 trained forest rangers. These are almost entirely natives of India; they enter the executive branch of the service, but those of special merit are eligible for promotion to the controlling staff.

The organisation of the Department may be shortly described as follows:—The Inspector-General of Forests is the head of the Department, and responsible to the Government of India. The Department in each province is presided over by a Conservator of Forests (or two, and even three in the large provinces), who is responsible to the local Government. He is assisted by Deputy and Assistant Conservators, each of whom controls the management of the forests in a district or other part of a province. Subordinated to this controlling staff are the executive officers divided into various grades, and they in their turn are assisted by

the protecting staff, consisting of foresters and guards, numbering many thousands.

In this manner a well-organised department has been built up during the last quarter of a century which has under its charge an immense Government property, consisting at present of some 55,000,000 acres of forest lands. Some of the forests were taken in hand before they had been destroyed, but by far the greater part of the area was taken over in a reduced and even ruined condition. Although a quarter of a century is only a short period in the life of a timber tree, the effects of protection and systematic management are everywhere apparent. Economic systems of utilisation have been introduced, a large proportion of the forests is successfully protected against the formerly annually recurring forest fires; young growth is allowed to spring up under the protection now afforded; sowing and planting are carried out when required; the forests are managed under carefully considered working plans; and all this without interfering with the acknowledged rights of the people, who receive every year enormous quantities of forest produce either free of charge or at comparatively low rates. In many parts of the country the people have come to recognise the importance to themselves of the proper preservation of a suitable forest area and this feeling is steadily extending.

What I have said above refers to British territory. Space does not permit my dealing with forestry in Native States, beyond mentioning that of late years many native rulers have commenced forest conservancy in their States, with the assistance and advice of officers of the Indian Forest Department, on lines similar to those followed in the Birtish territory.

And now the question may well be asked, how about the cost of all the elaborate organisation and the works of protection and improvement? Well, on that head, too, I can present you with what I consider satisfactory figures. The net surplus of the Indian Forest Department, after meeting all expenses, has been as follows since 1864 :—

NET REVENUE OF INDIAN STATE FORESTS.

1864-67 ...	... average annual net revenue	£106,615
1867-72 ...	... " " " "	133,929
1872-77 ...	... " " " "	212,919
1877-82 ...	... " " " "	243,792
1882-87 ...	... " " " "	384,752

The annual net revenue during the period 1882-87 was nearly four times that of the period 1864-67, and although I am not in

possession of the detailed figures for the years 1887-89 and 1888-89, I may state that the gross revenue realised in the latter year surpasses that for the period 1882-87 by about £300,000. Calculated for the whole area of the forests, the revenue is as yet small, but there is little doubt, if any, that twenty-five years hence the net surplus will be four times the present, provided the Government of India perseveres in the forest policy as developed in the past. The growth of trees is of slow progress, and of all branches of the administration of a country the Forest Department requires to be more thoroughly guided than any other by the watchword "Continuity of action."

(*To be continued*).

MOMBASSA MANGOES.—Colonel Pollock, writing from Mombassa, says :—"The mango here is excellent, almost as good as any graft, and of a very large size. The trees as soon as one crop is all but ripe, begin to flower and go on flowering at intervals : so, on the same tree may be seen fruit from the size of a large goose egg to fruit just forming. There is, therefore, on the same tree, fruit which ripen in succession, and the same tree gives mangoes for upwards of two to nearly three months, and virtually it bears all the year round.

"The trees are never bare, but for six weeks, from August to middle of October, there is very little ripe, but plenty of unripe fruit, fit for tarts, pickles, &c. I have planted a lot of kernels which I brought with me from Bombay and Bangalore, and they are getting on well. I have also some six of the best grafts from Bombay; time will show whether the plants are affected by the climate or whether the African mango is different from the Indian. I am going to graft some best kinds of Africans on the Indian grown from seed, and will let you know, if I remain long enough, the result. Please let me know if the mango kernels I sent you germinated. I can send you hundreds and hundreds, for the place is a mass of mango trees. Some of a delicious variety, as large as an ordinary musk melon, and others, equally as sweet—not much larger than a duck's egg and all but free from fibres."—*Agri-Horticultural Society's Proceedings.*

MANURIAL VALUE OF IRON.—The results of Professor Griffiths eight years' study of the matter have led him to the following conclusions :—(1). That in the case of those crops which develop large amount of chlorophyll, for example, beans, cabbages, turnips,

beats, &c. [and to these I would add maize and sugarcane], a soluble iron manure is beneficial. (2). An iron manure *greatly* increases the percentage of carbo-hydrates and albuminoids in various crops, and thus enhances their value as feeding stuffs. (3). That the sulphur of the ferrous sulphate acts as a food for the protoplasm of vegetable cells, and the iron for the chlorophyll. (4). That the application of sulphate of iron enables the plants to take up a greater quantity of phosphoric acid, thus causing an increased yield. [This is one of the most remarkable results of Mr. Griffiths' experiments, and is fully borne out by the analyses of the ashes of crops given in his work]. (5). Ferrous sulphate retains ammonia and phosphoric acid in the soil. Therefore it is an indirect as well as a direct plant-food. (6). It is an antiseptic agent capable of destroying the vegetable parasitic diseases which attack farm crops. [This property of iron sulphate was fully treated upon in my previous paper]. (8). Iron sulphate in *excess* is a plant poison. (9). Soluble iron compounds are necessary for the formation of green chlorophyll. (10). Recently (1888) French scientists have discovered that atmospheric nitrogen is "fixed" in the soil by means of bacteria; and they also state that the iron oxides accelerate the process of fixing atmospheric nitrogen in the soil. (11). Iron sulphate destroys moss in pastures. [I imagine it would also destroy fodder in lucerne]. (12). Iron sulphate is not a stimulant but a *direct* as well as an indirect plant-food.

The best method of applying iron sulphate is a top-dressing to land after the crops have appeared above ground. It is also best applied after a rainy day. The quantity of iron sulphate Professor Griffiths used in all his experiments was ½ cwt. to the acre, Sir J. B. Lawes found that 1½ cwt. was rather too much, although it did not kill the plants. It is essential, therefore, for the farmer to remember that from ½ cwt. to 1 cwt. per acre are the *only* proportions which will give good results with his crop. If an excess of iron sulphate has accidentally been added to land, the antidote is to add lime. If iron sulphate is used as a dry top-dressing it should be finely powdered and mixed with five to ten times its weight of sand or soil in order to obtain regular distribution. If in solution, then the quantity of water that the cart can distribute over one acre should first be ascertained, and ½ cwt. of the iron dissolved in it.

V. Extracts from Official Gazettes.

1.—Gazette of India—

No. 582.—*The 11th July, 1890.*—With reference to the Notification of the Government of Bengal, dated the 23rd ultimo, *Mr. C. G. Rogers*, Assistant Conservator of Forests, 1st grade, Bengal, is appointed to officiate as Instructor at the Forest School, Dehra Dún, with effect from 8th June, 1890, and until further orders.

No. 586.—*Mr. F. B. Dickinson*, Deputy Conservator of Forests, 2nd grade, Central Provinces, is appointed to officiate in the 1st grade of Deputy Conservators, during the absence on three months' privilege leave of *Colonel H. C. T. Jarrett*, V.C., B.S.C., Deputy Conservator, 1st grade, Central Provinces, with effect from the 12th May, 1890, and until further orders.

No. 588.—The following temporary promotions are made during the absence on furlough of *Mr. E. P. Popert*, Conservator of Forests, 3rd (officiating 2nd) grade, Pegu Circle, Burma, with effect from 9th July, 1890, and until further orders :—

Mr. P. J. Carter, Deputy Conservator, 2nd (officiating 1st) grade, Burma, to officiate in the 3rd grade of Conservators and to hold charge of the Pegu Circle.

Mr. J. Nisbet, Deputy Conservator, 2nd grade, Burma, to officiate in the 1st grade of that class.

2.—Madras Gazette—

The 11th March, 1890.—The following promotions are ordered with effect from 1st March, 1890 :—

T. Shunmuga Mudali, Forester, 1st grade, to be Forest Ranger, 5th grade.

M. Balaji Singh, Forester, 1st grade, to be Forest Ranger, 5th grade.

N. Balaji Singh, Forester, 1st grade, to be Forest Ranger, 5th grade.

The 19th June, 1890.—Ranger, 5th class, *Mr. J. S. Grogan*, (Salem,) to Forester, 2nd class, in the same district.

Forester, 1st class, *Mr. A. M. Clay*, (North Arcot,) to be Ranger, 5th class, acting sub. *pro tem.*

Mr. A. M. Clay, Ranger, 5th class, acting sub. *pro tem.*, from North Arcot to Salem.

Mr. J. G. F. Marshall, Sub-Assistant Conservator, 1st class, sub. *pro tem.*, from the Tinnevelly to North Arcot District.

Mr. C. P. Howell, Sub-Assistant Conservator, 1st class, sub *pro tem*, from the Trichinopoly to Tinnevelly District.

No. 251.—*The 20th June, 1890.—Mr. C. Somers Smith*, Assistant Conservator of Forests, Madras, has been granted by the Right Honourable the Secretary of State an extension of three months' extraordinary leave on medical certificate without pay.

No. 284 —*The 2nd July, 1890.—Mr. C. Du Pré Thornton*, Assistant Conservator of Forests, 3rd grade, is transferred from the Tinnevelly to the Madura District, as a temporary measure.

No. 282.—*The 4th July, 1890.—Mr. W. Carroll*, Acting District Forest Officer, North Arcot, is granted privilege leave for three months from date of relief, under Article 291 of the Civil Service Regulations.

No. 283.—*Mr. J. G. F. Marshall*, Sub-Assistant Conservator of Forests, Tinnevelly, to act as District Forest Officer, North Arcot, during the absence of *Mr. T. Sheffield* on other duty, or until further orders.

No. 298.—*The 12th July, 1890.—Mr. R. W. Morgan*, District Forest Officer, North Coimbatore, is granted privilege leave for two months and twenty-five days from or after the 11th instant, under Article 291 of the Civil Service Regulations.

3.—Bombay Gazette—

The 23rd June, 1890.—Mr. Luxmon Daji Joshi resumed charge of his office and duties as Sub-Assistant Conservator of Forests, Satara, from *Mr. C. Greatheed*, Divisional Forest Officer, Satara, on the forenoon of the 16th instant, after enjoying twenty-eight days out of the one month's privilege leave granted to him by the Conservator of Forests, Northern Circle. The unexpired portion of two days' leave is, therefore, hereby cancelled.

Messrs. R. C. Wroughton, Acting Conservator of Forests, Northern Circle, and *F. Gleadow*, Deputy Conservator of Forests and Divisional Forest Officer, North Thana, respectively delivered over and received charge of the Divisional Forest Office Working Plans, on the 20th instant, before office hours, in addition to his own office as Divisional Forest Officer, North Thána, as per Government Resolution No. 4197, dated 16th idem, Revenue Department.

No. 4575.—*The 30th June, 1890.—Mr. E. G. Oliver*, Assistant Conservator of Forests, 3rd grade, is promoted to the 2nd grade, from 16th April, 1890.

The 10th July, 1890.—Messrs. H. Murray and *W. A. Talbot*, Deputy Conservators of Forests, respectively delivered over and received charge of the Northern Division of Kánara on the 8th instant, before noon.

4.—Calcutta Gazette—

The 23rd June, 1890 —The services of *Mr. C. G. Rogers*, Assistant Conservator of Forests, who was relieved of the charge of the Darjeeling Sub-division, Darjeeling Forest Division, by *Mr. W. H. Lovegrove*, Assistant Conservator of Forests, on the after-

noon of the 7th June, 1890, are placed temporarily at the disposal of the Government of India for employment as Officiating Instructor at the Imperial Forest School, Dehra Dun, with effect from the 8th idem.

The 26th June, 1890.—Mr. H. H. Haines, Assistant Conservator of Forests, 2nd grade, is appointed to officiate in the 1st grade of Assistant Conservators, to fill an existing vacancy, with effect from the 21st April to the 22nd May, 1890.

Mr. W. H. Lovegrove, Assistant Conservator of Forests, 3rd grade, is promoted to the 2nd grade of Assistant Conservators, with effect from the 21st April, 1890.

The 26th June, 1890.—Mr. H. H. Haines, Assistant Conservator of Forests, 2nd grade, is appointed to officiate in the 1st grade of Assistant Conservators, with effect from the 8th June, 1890, to fill an existing vacancy.

The 1st July, 1890.—Mr. M. S. Fowler, Deputy Conservator of Forests, Bengal, has been permitted by Her Majesty's Secretary of State for India to return to duty within the period of the furlough for fifteen months granted to him in the Notification dated the 10th April, 1889. The three months' furlough granted to him under the Notification of the 15th May last is accordingly cancelled.

The 22nd July, 1890.—Mr. E. J. N. James, Sub-Assistant Conservator of Forests, attached to the Darjeeling Sub-division, Darjeeling Forest Division, is posted to the charge of the Teesta Sub-division of that division.

Mr. R. Quinnell, Sub-Assistant Conservator of Forests, on being relieved of the charge of the Teesta Sub-division, Darjeeling Forest Division, by *Mr. James*, is transferred to the Sunderbuns Forest Division, to which division he is attached for duty.

The 25th July, 1890.—The following promotions are made with effect from the 1st July, 1890:—

Babu Sree Dhur Chuckerbutty from the 2nd to the 1st grade of Sub-Assistant Conservator of Forests.

Mr. R. Quinnell from the 3rd to the 2nd grade of Sub-Assistant Conservator of Forests, and to officiate in the 1st grade.

5.—ASSAM GAZETTE—

No. 4183.—*The 18th June, 1890.*—Leave of absence for two months, under Article 291, Chapter XII., of the Civil Service Regulations, is granted to *Mr. J. C. Kelly*, Sub-Assistant Conservator of Forests, in charge of the Darrang Forest Division, with effect from the 27th May, 1890.

No. 4184.—*Babu Jogesvar Sur*, Sub-Assistant Conservator of Forests, Nowgong, received charge of the Darrang Forest Division, in addition to his own duties, from *Mr. J. C. Kelly*, on the forenoon of the 27th May, 1890.

No. 4684.—*The 2nd July, 1890.—Mr. C. P. Fisher*, Assistant Conservator of Forests, 2nd grade, is appointed to officiate as Assistant Conservator of Forests, 1st grade, *vice Mr. T. J. Campbell*, with effect from the 7th June, 1890.

No. 4685.—Leave of absence for three months, under Article 291, Chapter XII., of the Civil Service Regulations, is granted to *Babu*

Tara Kishor Gupta, Sub-Assistant Conservator of Forests, in charge of the Sylhet Forest Division, with effect from the 1st July 1890, or the subsequent date on which he may avail himself of it.

No. 4686.—*Mr. H. G. Young*, Assistant Conservator of Forests, Cachar, is appointed to hold charge of the Sylhet Forest Division, in addition to his own duties, during the absence on leave of *Babu Tara Kishor Gupta*, or until further orders.

No. 5064.—*The 10th July, 1890.*—Leave of absence for two months, under Articles 277 and 291, Chapter XII., of the Civil Service Regulations, is granted to *Babu Jogeswar Sur*, Sub-Assistant Conservator of Forests, Nowgong Division, with effect from the 15th August, 1890, or the subsequent date on which he may avail himself of it.

No 5065.—*Mr. J. C. Kelly*, Sub-Assistant Conservator of Forests, in charge of the Darrang Forest Division, is placed in charge of the Nowgong Division, in addition to his own duties, during the absence on leave of *Babu Jogeswar Sur*, or until further orders

No. 5467.—*The 15th July, 1890.*—*Mr. J. C. Kelly*, Sub-Assistant Conservator of Forests, was employed on duty with the Imperial Forest Survey Branch from the 27th May to 15th June, 1890.

No. 5468.—*Mr. C. P. Fisher*, Assistant Conservator of Forests, availed himself of the leave granted in General Department Notification No. 3908, dated the 10th June, 1890, on the afternoon of the 28th June, 1890.

No. 5469.—*Babu Tara Kishor Gupta*, Sub-Assistant Conservator of Forests, availed himself of the leave granted in General Department Notification No. 4685G., dated the 2nd July, 1890, on the afternoon of the 4th July, 1890.

6.—NORTH-WESTERN PROVINCES AND OUDH GAZETTE—

No. $\frac{2958}{\text{II-456A-45}}$.—*The 20th June, 1890.*—*Mr. F. B. Bryant*, Officiating Deputy Conservator of Forests, in charge of the Naini Tal Division, to hold charge of the Kumaun Division, in addition to his own duties, during the absence on leave of *Mr. A. G. Hobart-Hampden*, or until further orders.

No. $\frac{3075}{\text{II-820-14}}$.—*The 1st July, 1890.*—*Mr. B. A. Rebsch*, Officiating Deputy Conservator of Forests, in charge of the Bahraich Division, privilege leave for two months and twenty-six days, with effect from the 21st June, 1890, or subsequent date.

No. $\frac{3080}{\text{II-820-19}}$.—*Babu Raghunath Pathak*, Sub-Assistant Conservator of Forests, attached to the Gorakhpur Division, to hold charge of the Bahraich Division during the absence on privilege leave of *Mr. B. A. Rebsch*, or until further orders.

No. $\frac{612}{\text{VII-274B}}$.—*The 10th July, 1890.*—The Hon'ble the Lieutenant-Governor and Chief Commissioner is pleased to declare the undermentioned officer to have passed the Departmental Examination held on 21st April, 1890, and following days, in the subjects specified below :—

V.—FOREST OFFICER.

Land Revenue System.—Higher Standard.

Mr. M. Hill, Assistant Conservator of Forests, Kheri.

Vernacular.—Lower Standard.

Mr. M. Hill, Assistant Conservator of Forests, Kheri.

7.—PUNJAB GAZETTE—

No. 275.—*The 30th June, 1890.—Messrs. G. G. Minniken* and *W. Shakespear*, Deputy Conservators, respectively made over and assumed charge of the Bashahr Forest Division on the forenoon of the 19th March, 1890.

No. 278.—With the sanction of the Government of India the services of *Mr. G. G. Minniken*, Deputy Conservator of Forests, are placed temporarily at the disposal of the Patiála State, with effect from the forenoon of the 19th March, 1890.

No. 284.—*The 4th July, 1890.*—Consequent on the departure on privilege leave of *Mr. F. O. Lemarchand*, Deputy Conservator of Forests, the Lieutenant-Governor is pleased to make the following temporary promotions in the Forest Department with effect from the 11th May, 1890 :—

Mr. A. M. Reuther, Deputy Conservator, 4th grade, to act as Deputy Conservator, 3rd grade.

Mr. R. J. P. Pinder, Assistant Conservator of Forests, 1st grade, sub. *pro tem.*, to officiate as Deputy Conservator, 4th grade.

No. 295.—*The 12th July, 1890.—Bábu Jowála Parshád*, Sub-Assistant Conservator of Forests, assumed charge of the Rawalpindi Forest Division on the afternoon of 20th June, 1890, relieving *Mr. E. Forrest*, proceeding on furlough.

No. 298.—*Mr E. R. Murray*, Assistant Conservator of Forests, assumed charge of the Bashahr Forest Division on the afternoon of the 14th June, 1890, relieving *Mr. W. Shakespear*, Deputy Conservator of Forests, transferred to the North-Western Provinces and Oudh.

No. 302.—*The 15th July, 1890.*—Consequent on *Lála Jowála Parshád's* return from privilege leave, Officiating Sub-Assistant Conservator *Fazldín* reverted to Forest Ranger, 2nd grade, with effect from 13th June, 1890.

8.—CENTRAL PROVINCES GAZETTE—

No. 3840.—*The 24th June, 1890.—Mr. A. W. Blunt*, Assistant Conservator of Forests, 3rd grade, is promoted to the 2nd grade, with effect from the 1st December, 1889.

No. 3910.—*The 26th June, 1890.*—With reference to Notification No. 3335, dated the 2nd instant, *Colonel H. I. Lugard*, Deputy Commissioner, Damoh, made over, and *Mr. S. G. Paranjpe*, Sub-Assistant Conservator of Forests, took over, charge of the Forest Office, Damoh, on the forenoon of the 19th idem.

No. 4027.—*The 1st July, 1890.*—With reference to Notification No. 3673, dated the 16th June, 1890, *Colonel H. C. T. Jarrett*, v.c., Deputy Conservator of Forests, made over, and *Mr. A. Stewart*,

Deputy Conservator of Forests, received charge of the Saugor Forest Division on the forenoon of the 13th May last.

No. 4028.—With reference to Notification No. 3672, dated the 16th June, 1890, *Colonel H. C. T. Jarrett*, V.C., Deputy Conservator of Forests, availed himself, on the forenoon of the 13th May last, of the three months' privilege leave granted him.

No. 4046.—*The 2nd July, 1890.*—Consequent on the permanent transfer of *Mr. F. S. Barker*, Deputy Conservator of Forests, 4th grade, from Assam to these Provinces, the following reversions are ordered, with retrospective effect from the 20th December, 1889:—

Mr. A. E. Lowrie, Officiating Deputy Conservator, 4th grade, to Assistant Conservator, 1st grade, sub. *pro tem.*

Mr. A. A. Watson, Assistant Conservator, 1st grade, sub. *pro tem*, to Officiating Assistant Conservator, 1st grade.

Mr. A. F. Gradon, Officiating Assistant Conservator, 1st grade, to Assistant Conservator, 2nd grade.

No. 4047.—Consequent on the grant of two months' privilege leave to *Mr. F. C. Hicks*, Assistant Conservator of Forests, 1st grade, *Mr. A. F. Gradon*, Assistant Conservator, 2nd grade, is appointed to officiate as Assistant Conservator, 1st grade, from the 16th March, 1890.

No. 4048.—In consequence of the return from furlough of *Captain C. W. Losack*, Deputy Conservator of Forests, 1st grade, the following reversions are ordered, with effect from the 1st April, 1890:—

Notification No. 2382 of the 24th April, 1890, is hereby cancelled:—

Mr. W. P. Thomas, Officiating Deputy Conservator, 2nd grade, to Deputy Conservator, 3rd grade.

Mr H. Moore, Officiating Deputy Conservator, 3rd grade, to Deputy Conservator, 4th grade, sub. *pro tem.*

Mr G F. Taylor, Deputy Conservator, 4th grade, sub. *pro tem.*, to Officiating Deputy Conservator, 4th grade.

Mr. H. B. Anthony, Officiating Deputy Conservator, 4th grade, to Assistant Conservator, 1st grade, sub *pro tem.*

Mr. A. E. Lowrie, Assistant Conservator, 1st grade, sub. *pro tem.*, to Officiating Assistant Conservator, 1st grade.

Mr. A. F. Gradon, Officiating Assistant Conservator, 1st grade, to Assistant Conservator, 2nd grade.

No. 4049.—Consequent on the return from privilege leave of *Mr. F. C. Hicks*, Assistant Conservator of Forests, 1st grade, *Mr. A. Watson*, Officiating Assistant Conservator, 1st grade, reverted to Assistant Conservator, 2nd grade, from the 2nd May, 1890.

No. 4198.—*The 8th July, 1890.*—*Mr. W. King*, Deputy Conservator of Forests, is transferred from the charge of the Betul Forest Division to the Mandla Division.

No. 4199.—*Mr. F. S. Barker*, Deputy Conservator of Forests, at present in charge of the Mandla Division, is transferred to the Betul Division on being relieved by *Mr. W. King*, Deputy Conservator of Forests.

No. 4200.—With reference to Notifications Nos. 4198 and 4199, dated the 8th July, 1890, *Mr. F. S. Barker* and *Mr. W. King*, Deputy Conservators of Forests, respectively made over and

assumed charge of the Mandla Forest Division on the afternoon of the 7th June, 1890.

No 29.—*The 22nd July, 1890.*—Under the authority conferred on him by *Central Provinces Gazette* Notification No. 3555, dated the 12th June, 1890, the Conservator, Northern Circle, appoints Ranger *Mahomed Baksh*, Nimar Forest Division, and Ranger *Mohan Lal*, Mandla Forest Division, to exercise the powers described in Section 67 of Act VII. of 1878 (as amended by Act V. of 1890).

4.—BURMA GAZETTE—

No 86.—*The 14th June, 1890.*—Under the provisions of Article 283 of the Civil Service Regulations privilege leave for two months and twelve days is granted to *Mr. C. L. Toussaint*, Assistant Conservator of Forests, with effect from the date on which he may avail himself of it.

No. 87.—*The 17th June, 1890.*—*Mr. D. L. K. Calderwood*, probationary Sub-Assistant Conservator of Forests, is confirmed in the grade of Sub-Assistant Conservator of Forests, with effect from the 20th March, 1890.

No. 89.—*The 21st June, 1890* —Under the provisions of Article 340 *(b)* of the Civil Service Regulations furlough to Europe for six months is granted to *Mr. E. P. Popert*, Conservator of Forests, Pegu Circle, with effect from the 1st July, 1890, or the subsequent date on which he may avail himself of it.

No. 90.—*The 23rd June, 1890.*—The following transfer is ordered:—

Mr. G. R. Long, Assistant Conservator of Forests, from Tharrawaddy to the Myanaung sub-division of the Western division, Pegu Circle.

No. 91.—The following transfers are ordered:—

Mr. G. F. R. Blackwell, Assistant Conservator of Forests, 1st grade, and officiating Deputy Conservator, 4th grade, from Alôn to the Myadaung sub-division of the Katha Forest Division.

Mr. W. J. Lane-Ryan, Sub-Assistant Conservator of Forests, from Tigyaing to the Pyinmana Forest Division.

No. 10.—*Mr. H. Carter*, Assistant Conservator of Forests, made over, and *Mr. G. Q. Corbett*, Officiating Deputy Conservator of Forests, received, charge of the Working Plans Division on the forenoon of the 19th instant.

No. 11.—*Mr. G. Q. Corbett*, Officiating Deputy Conservator of Forests, returned on the forenoon of the 19th instant from the privilege leave granted him in Revenue Department Notification No. 48F., dated the 19th March last, and of which he availed himself on the 21st idem.

No. 12.—*The 2nd July, 1890* —*Mr. P. J. Carter*, Deputy Conservator of Forests, made over, and *Mr. G. Q. Corbett*, Officiating Deputy Conservator of Forests, received, charge of the Tharrawaddy Division on the afternoon of the 1st instant.

No. 97.—*The 7th July, 1890.*—*Mr. F. J. Branthwaite*, Assistant Conservator of Forests, 3rd grade, is promoted to Assistant Conservator, 2nd grade, with effect from the 2nd June, 1890.

No. 98.—*The 9th July, 1890.*—*Mr. G. Q. Corbett*, Officiating Deputy Conservator of Forests, in charge of the Working Plans Division, is appointed to the charge of the Tharrawaddy Division, in addition to his other duties, with effect from the 1st July, 1890, afternoon.

No. 101.—*The 12th July, 1890.*—The following promotion is ordered with effect from the 2nd June, 1890 :—

Mr. C. L. Toussaint, Assistant Conservator of Forests, 2nd grade, to be Assistant Conservator, 1st grade.

No. 102.—Under the provisions of Article 291 of the Civil Service Regulations privilege leave was granted to *Mr W. F. L. Tottenham*, Assistant Conservator of Forests, from the 21st April to the 5th May, 1890, both days inclusive.

No. 103.—*The 14th July, 1890.*—*Mr. E. P. Popert*, Conservator of Forests, Pegu Circle, made over charge of the Pegu Circle to *Mr. P. J. Carter*, Deputy Conservator of Forests, on the 8th July, 1890, after noon.

No. 104.—Under the provisions of Article 291 of the Civil Service Regulations privilege leave for three months is granted to *Mr. C. E. Muriel*, Deputy Conservator of Forests, with effect from the date on which he may avail himself of it.

No. 105 —*Mr. C. W. Palmer*, Deputy Conservator of Forests, is transferred from Bhamo to the charge of the Yaw Forest Division during the absence of *Mr. L. A. W. Rind*, on privilege leave, or until further orders.

No. 106.—*Mr. E. A. O'Bryen*, Assistant Conservator of Forests, is placed in charge of the Bhamo Forests Division during the absence of *Mr. C. W. Palmer*, or until further orders.

10.—MYSORE GAZETTE—

No. 104.—*The 5th July, 1890.*—*Mr. K. Shamaiengar*, Forest Probationer, is transferred from the Shimoga to the Mysore District.

No. 107.—*The 7th July, 1890.*—The following promotions of Forest Officers are sanctioned :—

Messrs. S. A. Bapu Rao and *Y. Sitaramaiya*, Sub-Assistant Conservators of Forests, to be Assistant Conservators of Forests, 3rd grade, with effect from the 30th June, 1890.

No. 125.—*The 7th July, 1890.*—The following temporary promotion and transfer of Forest Officers are ordered with effect from 12th April, 1890 :—

Mr. E. P. Lovery, Assistant Conservator of Forests, 1st grade, Shimoga District, to act as Superintendent of Forests during the absence of *Mr. C. E. M. Russell* on leave, or until further orders, but to continue to be in charge of the Shimoga District Forests.

Mr. C. Narayan Rao, Assistant Conservator of Forests, 2nd grade, Mysore District, to act as Assistant Conservator of Forests, 1st grade, *vice Mr. E. P. Lovery*, and is transferred to the Bangalore District.

Mr. B. Ramaswami Iyer, Sub-Assistant Conservator of Forests, to act as Assistant Conservator of Forests, 3rd grade, and to be in charge of the Mysore District Forests, *vice Mr. Narayan Rao.*

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